SPIRE AOTs, Products and Quick Look Tools

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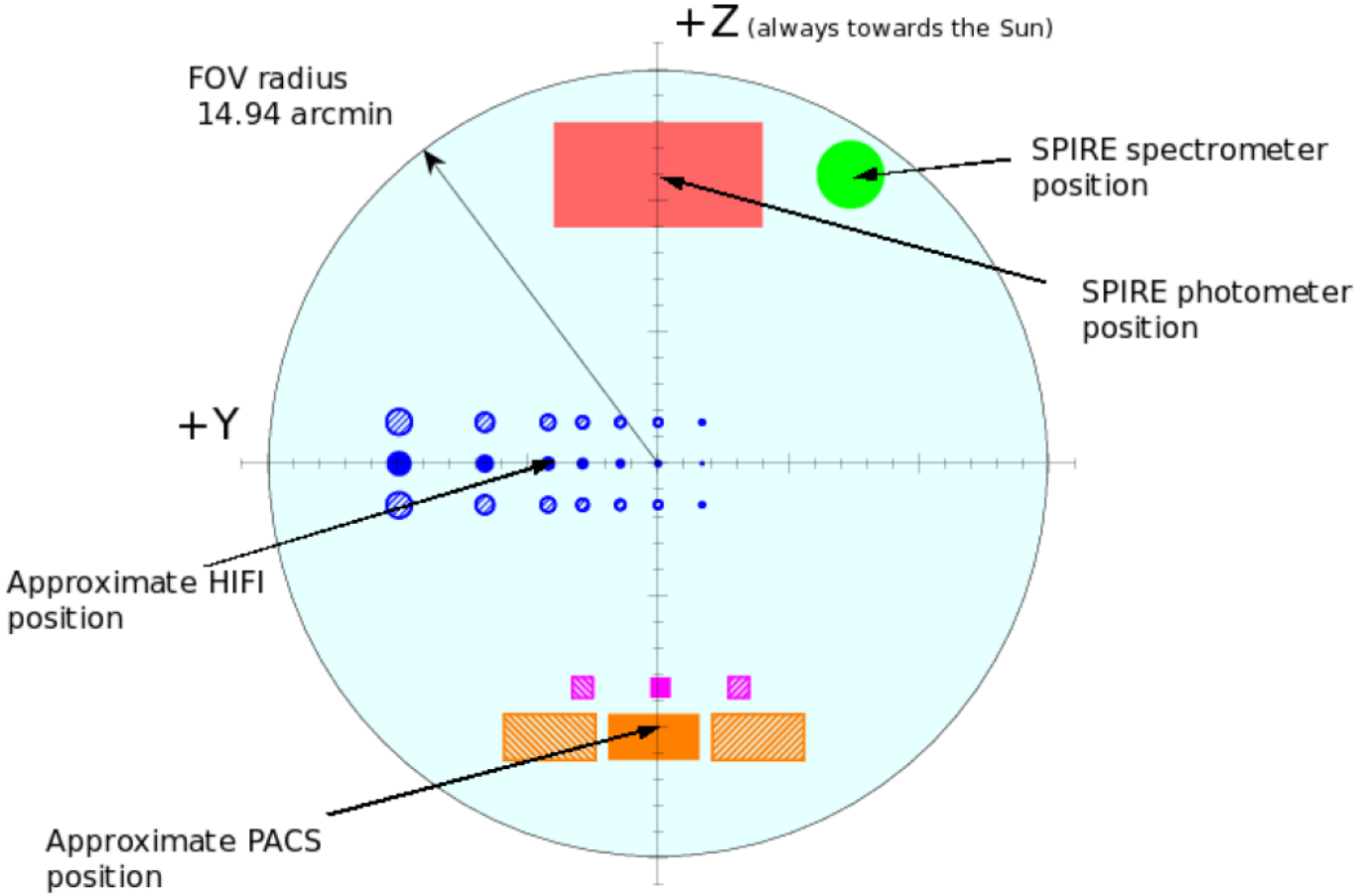
on behalf of the SPIRE ICC

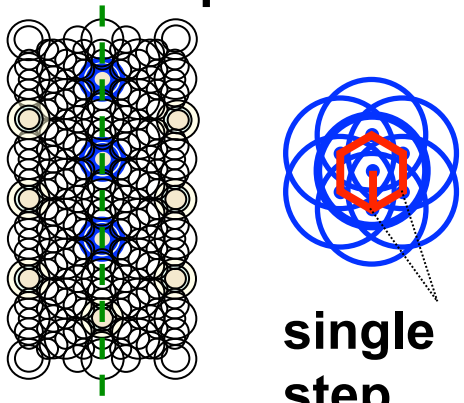
SPIRE in the Herschel Focal Plane



Photometer AOT

7 point jiggle (point source)

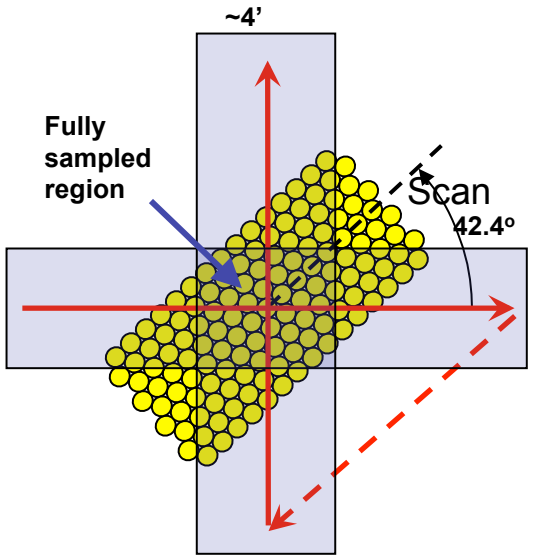
126” chop + nod



single step ~ 6”

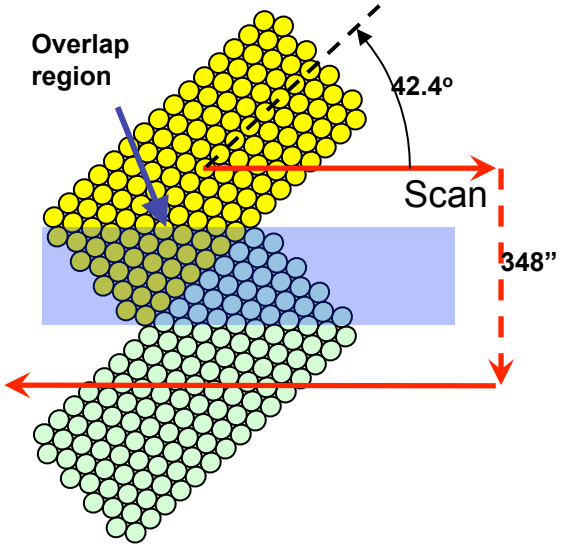
7-point jiggle for **point source photometry**, to compensate pointing error and under-sampling. Chopping and nodding at each jiggle position.

small map



Single cross scan **at 84.8º** replaces Jiggle map. Scan map at speeds of **30** and **60 ”/sec.** Full spatial sampling in center of scans.

scan (large) map

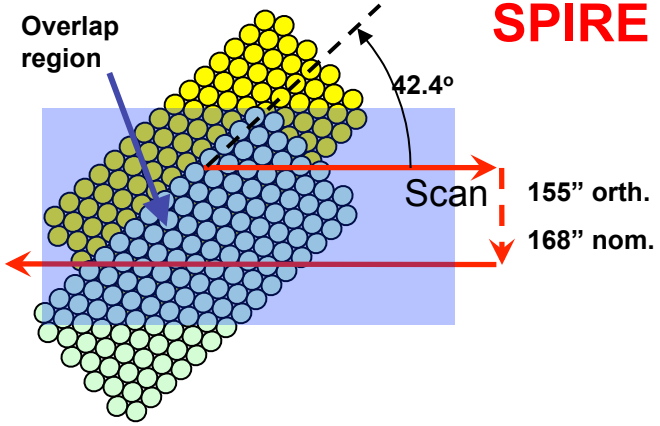


Scan map at speeds of **30** and **60 ”/sec** is most efficient mode for **large-area surveys**. Parameters are optimized for full spatial sampling and uniform distribution of integration time. **Cross scan capability (84.8º)**

Parallel Mode SPIRE and PACS

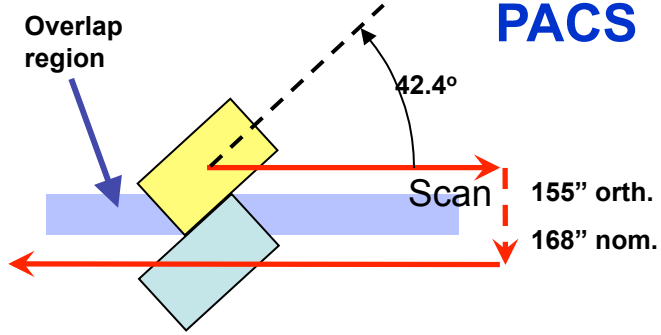
- Scan maps at speeds of **20** and **60”/sec** with PACS and SPIRE active in parallel are useful for **large-area surveys**.
- The distance between PACS and SPIRE apertures is 21 arcmin.
- Two almost orthogonal (**84.8°**) directions for **cross scanning** are available.

SPIRE Geometry



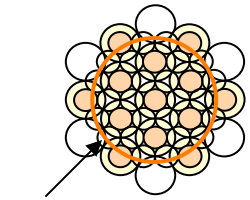
Considerable **redundancy** for SPIRE due to smaller scan distance needed by PACS arrays. **Sample rate lowered** from 16 to 10Hz.

PACS Geometry



Even field coverage for PACS. **Additional frame averaging needed to keep data rate down.** Blue array frames are averaged by additional factor two compared to PACS only mode.

Spectrometer AOT



Overlapping spectrometer arrays projected on the sky

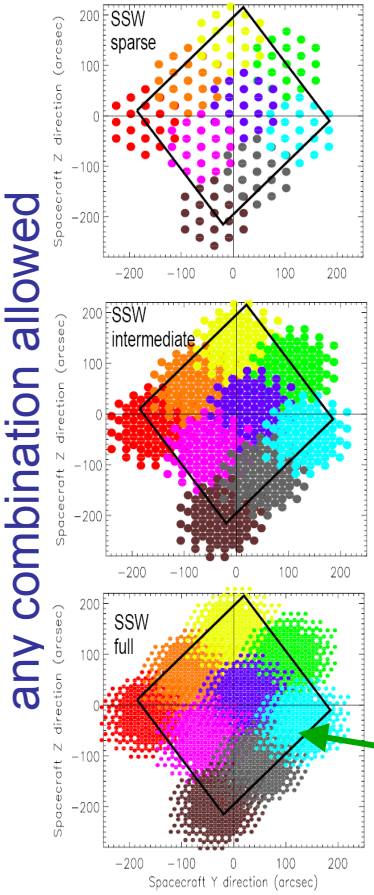
Image Sampling

- Sparse
- Intermediate
- Full

Pointing Mode

- Single Pointing
- Raster Pointing

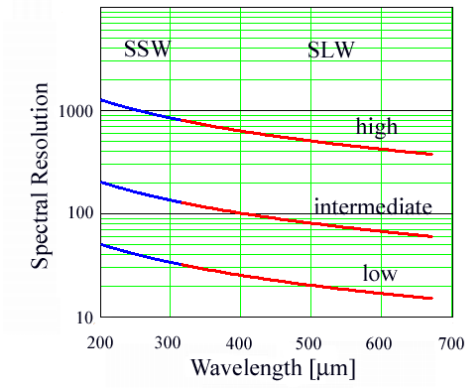
example 3 x 3 map



Each color shows the unvignetted beams of the same array for all sampling positions (jiggles) at one raster position.

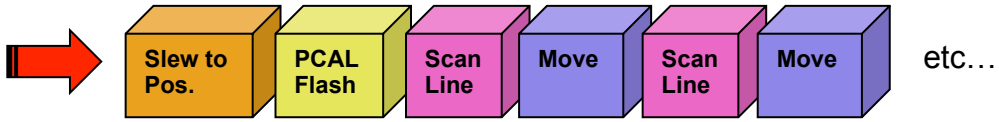
Spectral Resolution

- High 0.04 cm^{-1}
- Medium 0.25 cm^{-1}
- Low 1.0 cm^{-1}
- High & Low 0.04/1.0 cm^{-1}

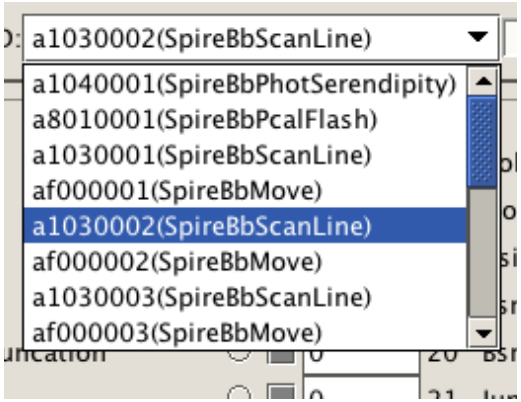


Building Blocks

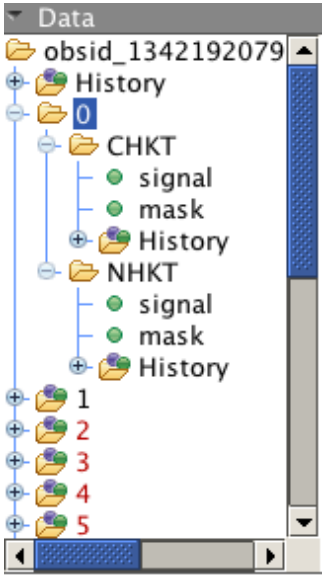
- Observations are assembled from building blocks (BB).



- The data is organized following this structure.
- The data in each BB is hirarchically organized in products and contexts
- Contexts can be thought of as directories or subdirectories.
- Products and contexts can be inspected in viewers like Context Viewer, Product Viewer, and Mask Editor.



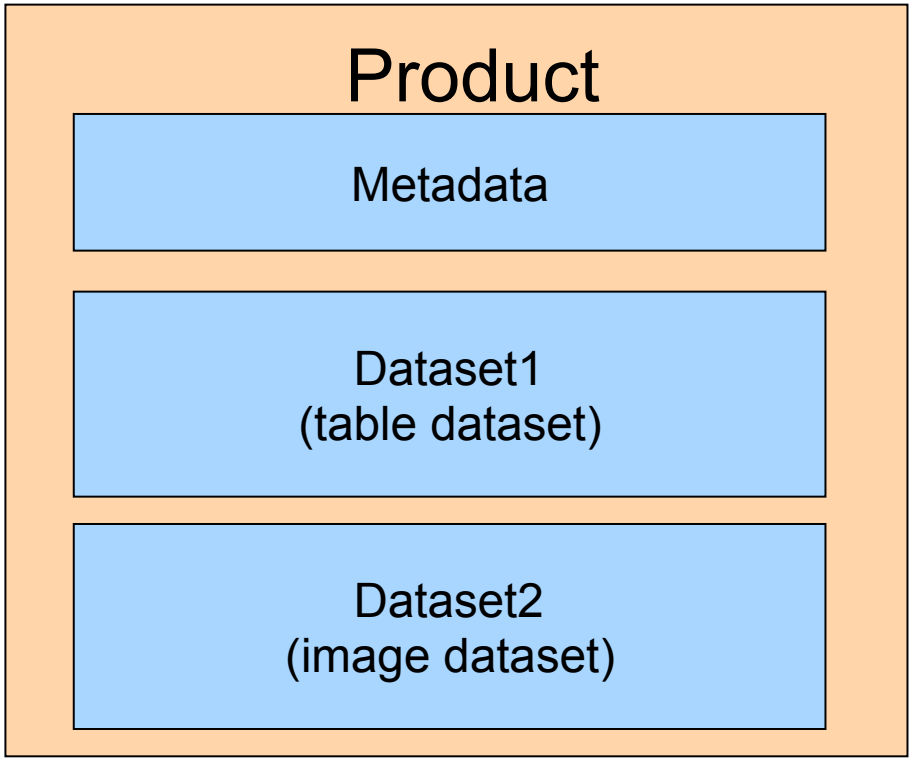
BBs in the Mask Editor



BB substructure in the Context Viewer

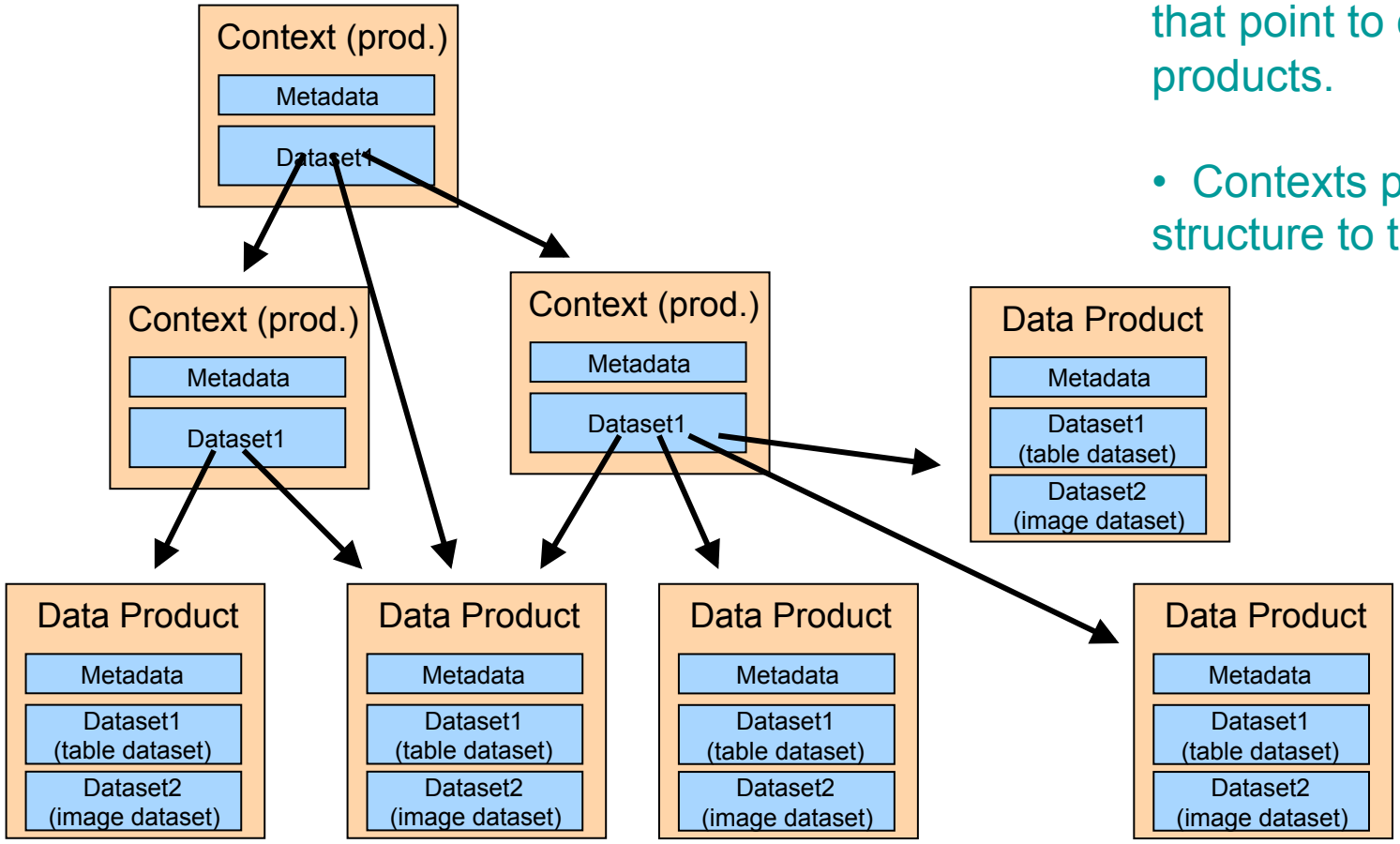
General Product Structure

- Products are containers for datasets that can be stored within the HCSS system.
- A product can be exported to other software using a FITS representation.



- Products contain:
  - Metadata,
  - Datasets
  - Processing history
- Types of datasets are:
  - Array dataset
  - Table dataset
  - Composite dataset
  - Spectrum1d
  - Spectrum2d
- Generic Product Types are:
  - SimpleImage
  - SimpleCube
  - SpectralSimpleCube
  - Context

Contexts

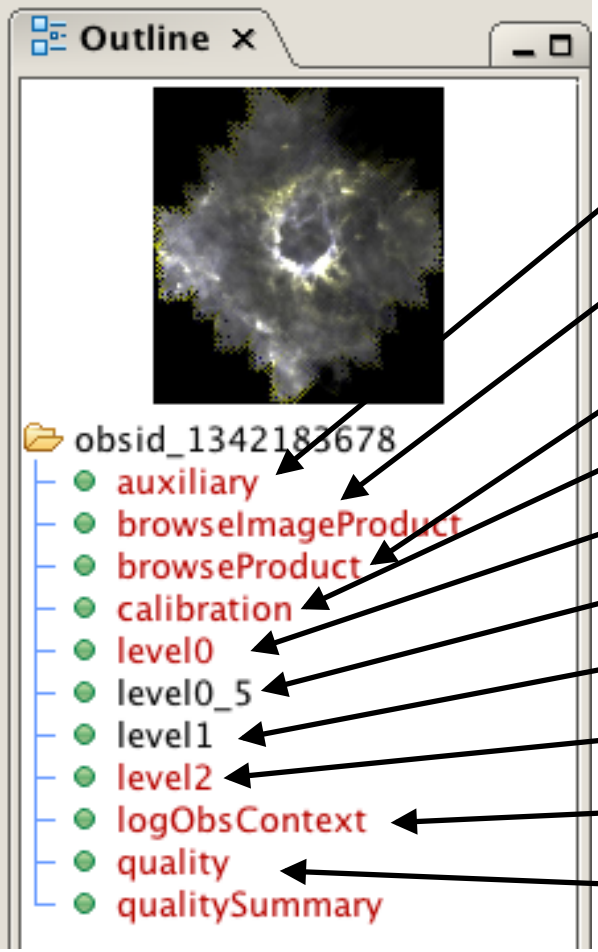


- Contexts are products that point to other products.
- Contexts provide structure to the data.

My Data

- In general an observation consists of the following products:
- Observation Context:
  - auxiliary product (pointing information, satellite temperatures, commands
  - browse image product (browse colour image for archive)
  - browse product (browse info about observation)
  - calibration products (calibration tree used to process observation)
  - level 0 (raw) data (reformatted raw digital data)
  - level 0.5 (data converted to engineering units like V, K, …)
  - level 1 (calibrated data, flux timelines, interferograms, spectra)
  - level 2 (higher processing level: maps, point source spectra)
  - level 2.5 (combined maps of several observations)
  - log (processing log)
  - Quality (quality data for observation)

Photometer Observation Context



These are all contexts!

Auxiliary data: Pointing, siam, uplink info, etc…

Browse image product: Simple representation of final map for archive quicklook

Browse product: Another browse product

Calibration data: Products used for processing

Level 0: Raw unprocessed reformatted data

Level 0.5: Data converted to engineering units

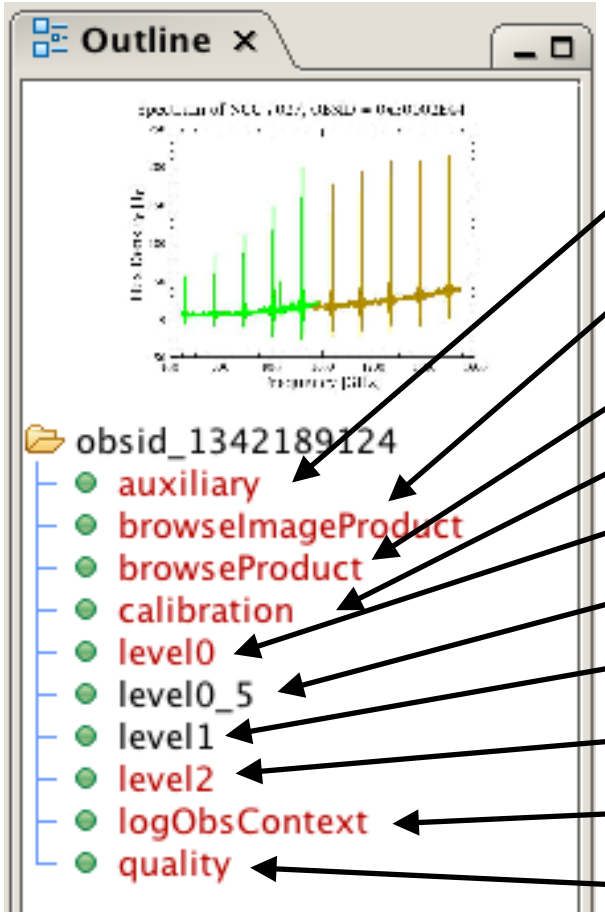
Level 1: Calibrated flux timelines [Jy/pixel]

Level 2: Images

Reduction Log: Data reduction history

Quality control data: Tells whether things went O.K.

Spectrometer Observation Context



Auxiliary data: Pointing, siam, uplink info, etc...

Browse image product: Simple representation of final map for archive quicklook

Browse product: Another browse product

Calibration data: Products used for processing

Level 0: Raw unprocessed reformatted data

Level 0.5: Data converted to engineering units

Level 1: Spectra [W/m^2/Hz/sr]+ raw interferograms

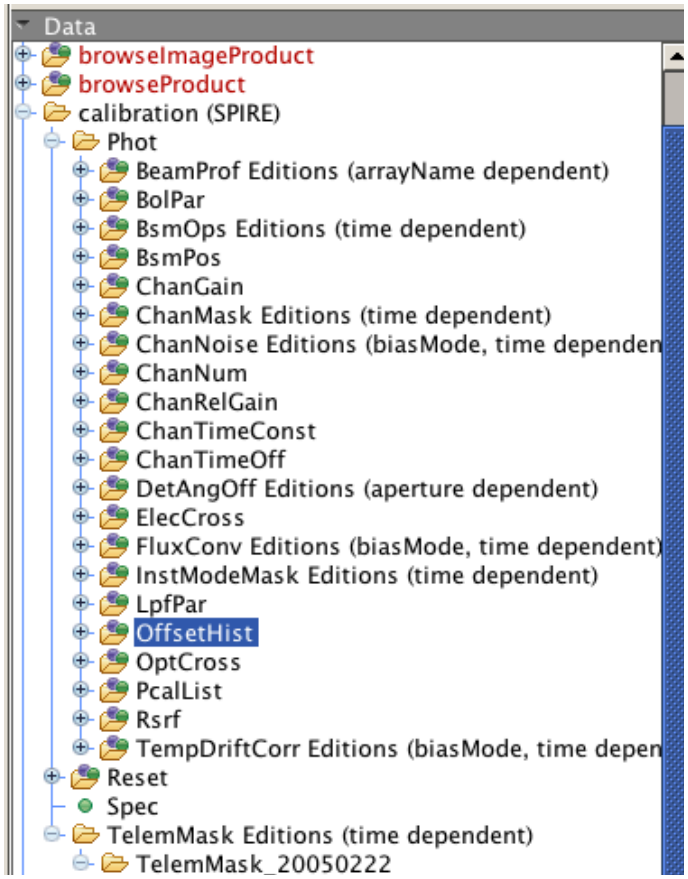
Level 2: Spectral cube or point source spectrum

Reduction Log: Data reduction history

Quality control data: Tells whether things went O.K.

Calibration Context ("Tree")

- Nominally part of every observation.
- Most data are tables that normally don't change.
- Exceptions are Offset History, and Reset History.
- The command `obs.calibration.update(cal)` knows the difference and will do the right thing when updating the calibration tree to a new version.
- After installing HIPE you need to install the corresponding calibration tree.



Viewers in HIPE

- Double click will invoke the default viewer or the last one that was used.
- Viewers are selected by right clicking on the context or dataset, opening a pop-up menu there and selecting the viewer.
- Other tools like editors are tasks and can be found in the tasks view.
- "Applicable" will show only tasks that work with the selected data.
- Double-click will bring up a default GUI.

This would be a good time for a demo!

There are some more slides for your reading pleasure.

Tools to Show Level 2 Data

- **Level2: Maps**
- Observation Context
  - Observation Viewer, Context Viewer, Product Viewer
- Level 2
  - Context Viewer, Product Viewer
- Level 2 Simple Image
  - Image viewer for array datasets to display flux, error or coverage map as image
  - WCS explorer to look at world coordinates of images
  - Product viewer to look at metadata
  - Many additional tools (contours, profiles, photometry etc.)
- Level 2 Image Dataset
  - Dataset Viewer for numerical display
  - Image viewer for array datasets to display as an image

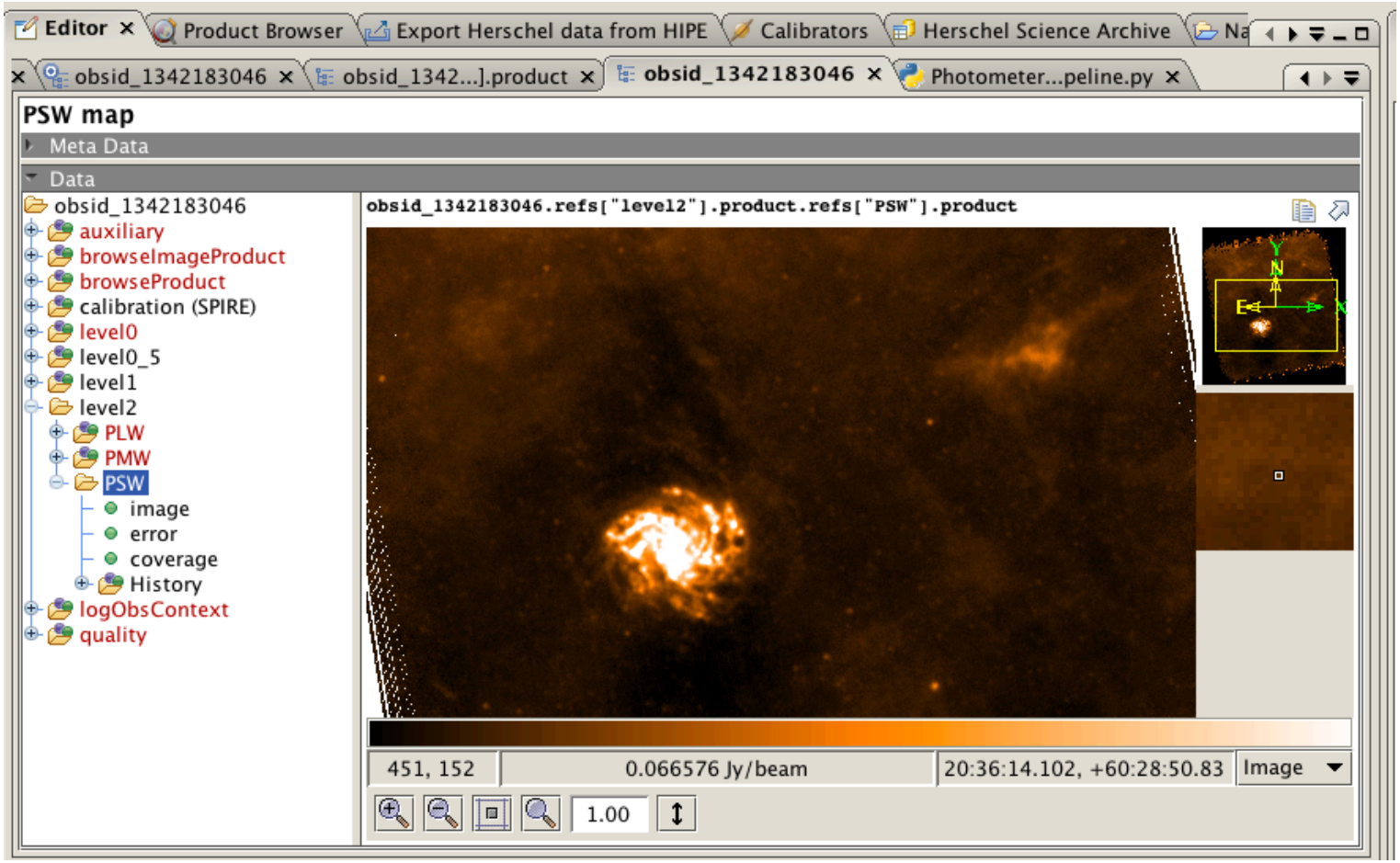
Tools to Show Level 1 Data

- **Level 1: Flux timelines**
- Level 1
  - Context Viewer, Product Viewer
- Spire map contexts (bulding blocks) at Level 1
  - Product Viewer
  - Detector Timeline Viewer
  - Spec SDS Explorer
- Tables within products at Level 1
  - Dataset viewer
  - Spectrum Explorer
  - TablePlotter
  - OverPlotter
  - Power Spectrum Generator

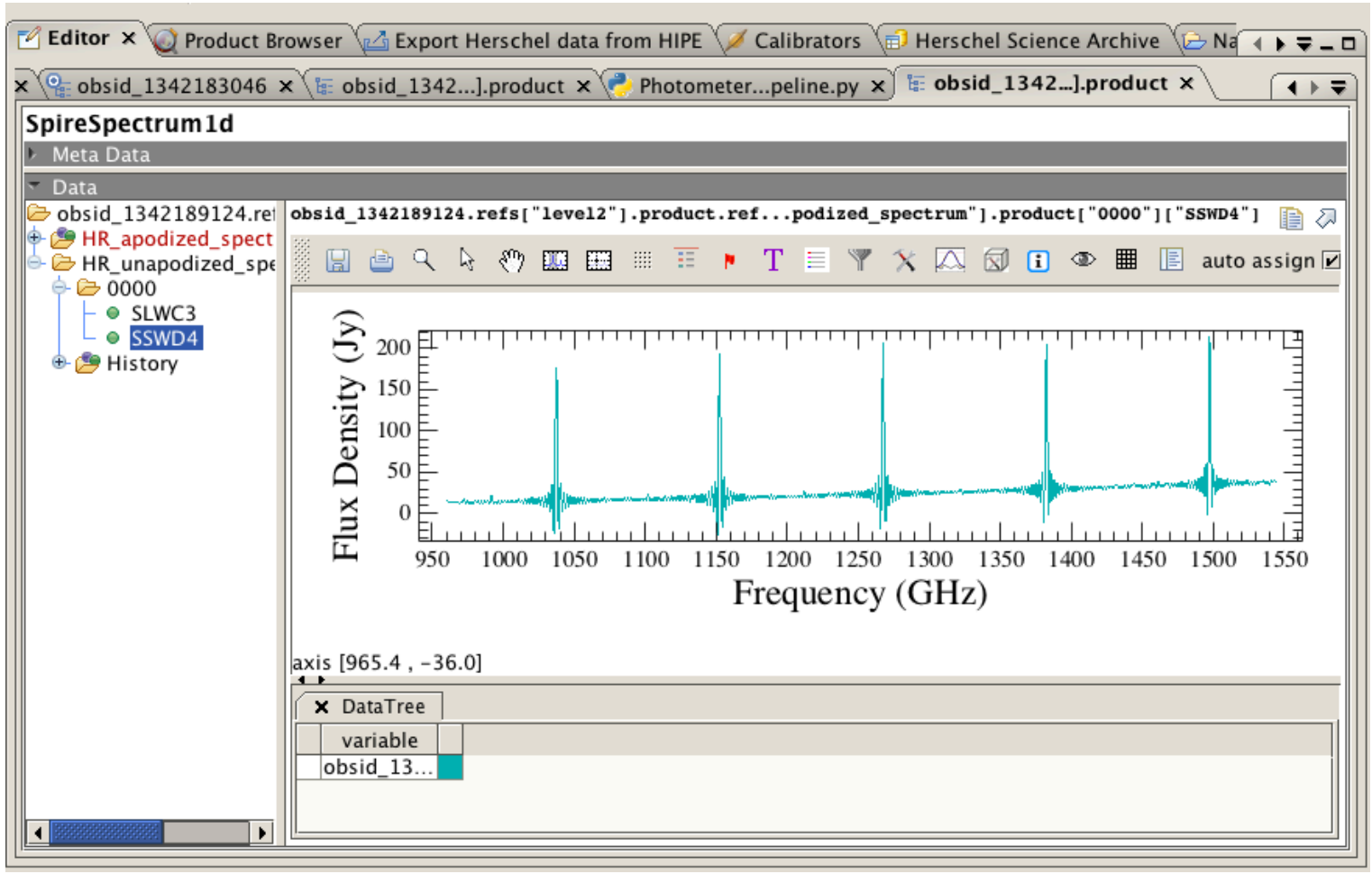
Tools to Look at Level 0.5 Data

- **Level 0.5: Signal timelines in engineering units**
- Level 0.5
  - Context Viewer, Product Viewer
- Building blocks at Level 0.5
  - Context Viewer, Product Viewer
- PDT/SDT within building blocks at Level 1
  - Product Viewer
  - Detector Timeline Viewer
- NHKT/CHKT/POT/SCUT within building blocks at Level 1
  - Product Viewer
- Tables within products at Level 1
  - Dataset viewer
  - TablePlotter
  - OverPlotter
  - Power Spectrum Generator

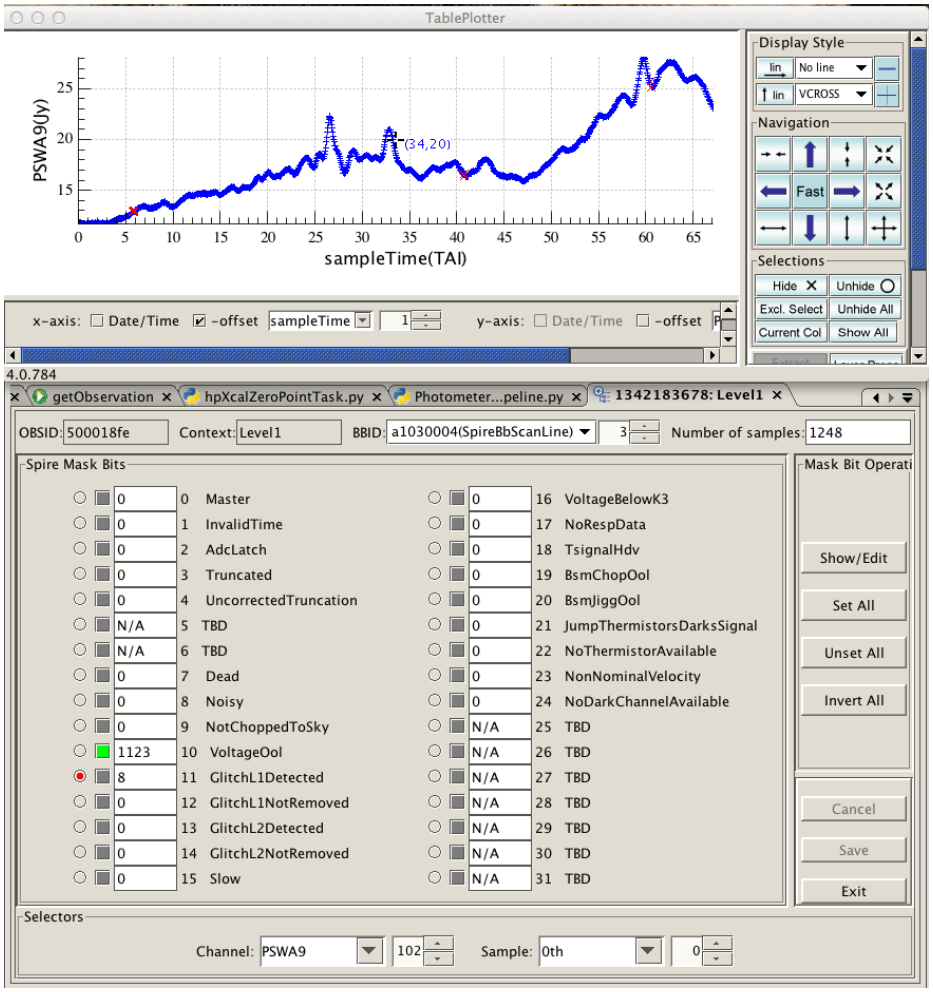
Level 2 Map in Context Viewer



FTS Spectrum in Context Viewer



Level 1 Flags in Mask Editor



- Selectors for building block, detector channel, sample.
- Set flag appears as green square.
- Select detector timeline for display with red radio button.
- Table Plotter window with Detector timeline will appear when hitting “Show/Edit”.
- Samples can be de-selected/re-selected with the mouse pointer.

Interferogram in SDI Explorer